

SEMICONDUCTOR PRESSURE SENSOR AND METHOD FOR MANUFACTURING SEMICONDUCTOR PRESSURE SENSOR

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention is related to a semiconductor pressure sensor including a wiring pattern formed to contact a part of a resistor provided on a diaphragm exposed at a penetrating hole and the wiring pattern is formed on an insulating film and the diaphragm, and a method for manufacturing the semiconductor pressure sensor.

[0003] The present invention may apply to a semiconductor pressure sensor including a wiring pattern formed on part of a resistor provided on a diaphragm exposed at a penetrating hole and the wiring pattern is formed on an insulating film and the diaphragm, and a method for manufacturing the semiconductor pressure sensor.

[0004] 2. Description of the Related Art

[0005] FIG. 1 shows a cross-sectional view of a related art semiconductor pressure sensor, and FIG. 2 is a plan view of the semiconductor pressure sensor indicated in FIG. 1.

[0006] Referring to FIG. 1 and FIG. 2, a related art semiconductor pressure sensor 100 includes a diaphragm 101, a diaphragm support part 102, first resistors 104 and 105, second resistors 106 and 107, an insulating film 109, wiring patterns 111 through 114, and a protective film 120.

[0007] The diaphragm 101 has a plate shape for being flexible when external pressure is applied. The diaphragm support part 102 has a frame shape provided at peripheral parts of the diaphragm 101. The diaphragm support part 102 is thicker than the diaphragm 101. The diaphragm support part 102 supports the diaphragm 101. For examples a semiconductor substrate may be used as a base material of the diaphragm 101 and the diaphragm support part 102.

[0008] The first and second resistors 104 through 107 are formed on a top surface 101A of the diaphragm 101. The first resistors 104 and 105 are base resistors and arranged approximately at the center of the diaphragm 101. The second resistors 106 and 107 are arranged at peripheral parts of the diaphragm 101.

[0009] The insulating film 109 is formed to cover the top surface 101A of the diaphragm 101, a top surface 102A of the diaphragm support part 102, and part of the top surface of the first and second resistors 104 through 107. The insulating film 109 includes penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1 and 119-2. The penetrating parts 116-1 and 116-2 are formed to expose the top surface of the first resistor 104. The penetrating parts 117-1 and 117-2 are formed to expose the top surface of the first resistor 105. The penetrating parts 118-1 and 118-2 are formed to expose the top surface of the second resistor 106. The penetrating parts 119-1 and 119-2 are formed to expose the top surface of the second resistor 107. The penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1, and 119-2 are formed by isotropic etching of the insulating film 109.

[0010] The wiring pattern 111 is formed at bottom parts of the penetrating parts 116-1 and 118-1, side parts 116-1A and 118-1A of the penetrating parts 116-1 and 118-1, and on the top part 109A of the insulating film 109. Thereby, the wiring pattern 111 electrically connects the part of the first resistor 104 exposed by the penetrating part 116-1 and the part of the

second resistor 106 exposed by the penetrating part 118-1. The wiring pattern 111 is electrically connected to a ground terminal (not shown).

[0011] The wiring pattern 112 is formed at bottom parts of the penetrating parts 117-1 and 118-2, side parts 117-1A and 118-2A of the penetrating parts 117-1 and 118-2, and on the top part 109A of the insulating film 109. Thereby, the wiring pattern 112 electrically connects the part of the first resistor 105 exposed by the penetrating part 117-1 and the part of the second resistor 106 exposed by the penetrating part 118-2. The wiring pattern 112 is electrically connected to a first output terminal (not shown).

[0012] The wiring pattern 113 is formed at bottom parts of the penetrating parts 116-2 and 119-2, side parts 116-1A and 118-2A of the penetrating parts 116-2 and 119-2, and on the top part 109A of the insulating film 109. Thereby, the wiring pattern 113 electrically connects the part of the first resistor 104 exposed by the penetrating part 116-2 and the part of the second resistor 107 exposed by the penetrating part 119-2. The wiring pattern 113 is electrically connected to a second output terminal (not shown).

[0013] The wiring pattern 114 is formed at bottom parts of the penetrating parts 117-2 and 119-1, side parts 117-2A and 119-1A of the penetrating parts 117-2 and 119-1, and on the top part 109A of the insulating film 109. Thereby, the wiring pattern 114 electrically connects the part of the first resistor 105 exposed by the penetrating part 117-2 and the part of the second resistor 107 exposed by the penetrating part 119-1. The wiring pattern 114 is electrically connected to a power source terminal (not shown).

[0014] FIG. 3 through FIG. 8 show a fabrication process of a related art semiconductor pressure sensor. For the parts of the semiconductor pressure sensor 100 indicated in FIG. 1 and FIG. 2, the same reference symbols are used for the identical parts in FIG. 3 through FIG. 8. Further, in FIG. 3 through FIG. 8, the first resistor 105 and the penetrating parts 117-2 and 117-2 are omitted.

[0015] The method for fabricating a related art semiconductor pressure sensor 100 will be described by referring FIG. 3 through FIG. 8. In FIG. 3, at first, first resistors and second resistors 104 through 107 are formed on a top surface 125A of a semiconductor substrate 125, which is a base material of a diaphragm 101 and a diaphragm support part 102, followed by forming an insulating film 109 for covering the top surface 125A of the semiconductor substrate 125 and the first and second resistors 104 through 107.

[0016] Next, in FIG. 4, a resist film 126 having opening parts 126A and 126B is formed on the insulating film 109. The opening parts 126A are formed to expose the top part 109A of the insulating film 109 corresponding to positions where penetrating parts 116-1, 117-1, 118-1 and 119-1 are to be formed.

[0017] In the process of FIG. 5, parts of the insulating film 109 exposed through the openings 126A and 126B of the resist film 126 are etched by wet etching to form penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1 and 119-2. The penetrating parts 116-1, 116-2, 117-1, 117-2, 118-1, 118-2, 119-1 and 119-2 formed in this manner have circular arc shapes. Thereby, the angles formed by the bottom plane 109B of the insulating film 109 and the side planes 116-1A, 116-2A, 117-1A, 117-2A, 118-1A, 118-2A, 119-1A and 119-2A of the penetrating parts 116-1, 116-2, 117-1, 117-2, 119-1, 118-2, 119-1 and 119-2 approach being